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**Literature Search Results**

**Search request date:** 13th February 2014  
**Search completion date:** 21st February 2014  
**Search completed by:** Jan Badcock

**Enquiry Details**

- The use of metronome paced speech in stammering treatment
- Prolonged speech treatment in stammering/ stuttering and
- Altered auditory feedback in stammering/ stuttering
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Guidance

Resource Manual for Commissioning and Planning Services for SLCN
RCSLT 2009
This document from the Royal College of Speech and Language Therapists has a large section on stammering, examining the evidence base.
http://www.rcslt.org/speech_and_language_therapy/commissioning/fluency_plus_intro

Evidence

Effectiveness of Behavioral Stuttering Treatment: A Systematic Review and Meta-Analysis
Carl Herder, Courtney Howard, Chad Nye, Martine Vanryckeghem
Contemporary Issues in Communication Science and Disorders • Volume 33 • 61–73 • Spring 2006
ABSTRACT: The objective of this study was to conduct a systematic review and meta-analysis of the research relating to behavioral stuttering treatment. Detailed descriptions of the information retrieval, inclusion criteria, study coding, and effect size computations are provided. A total of 375 citations were identified for potential inclusion using electronic and hand-search strategies. Of the 12 included studies, six reported outcomes for treated versus nontreated participants, yielding a significant effect size of 0.91. The remaining six studies compared the effectiveness of two different treatments and yielded a nonsignificant effect size of 0.21. These data support the claim that intervention for stuttering results in an overall positive effect. Additionally, the data show that no one treatment approach for stuttering demonstrates significantly greater effects over another treatment approach.

Metronome

Systematic Studies of Modified Vocalization: Effects of Speech Rate and Instatement Style During Metronome Stimulation
Jason H. Davidow; Anne K. Bothe; Jessica D. Richardson; Richard D. Andreatta
Purpose: This study introduces a series of systematic investigations intended to clarify the parameters of the fluency-inducing conditions (FICs) in stuttering.
Method: Participants included 11 adults, aged 20–63 years, with typical speech-production skills. A repeated measures design was used to examine the relationships between several speech production variables (vowel duration, voice onset time, fundamental frequency, intraoral pressure, pressure rise time, transglottal airflow, and phonated intervals) and speech rate and instatement style during metronome-entrained rhythmic speech.
Results: Measures of duration (vowel duration, voice onset time, and pressure rise time) differed across different metronome conditions. When speech rates were matched between the control condition and metronome condition, voice onset time was the only variable that changed.
Conclusion: Results confirm that speech rate and instatement style can influence speech production variables during the production of fluency-inducing conditions. Future studies of normally fluent speech and of stuttered speech must control both features and should further explore the importance of voice onset time, which may be influenced by rate during metronome stimulation in a way that the other variables are not.
Some Reactions and Responses of Stutterers to a Miniaturized Metronome and Metronome-Conditioning Therapy: Three Case Reports
This paper reports on three adult stutterers' reactions to a miniaturized metronome and a metronome-conditioning stuttering rehabilitation program. In two of the cases described, primary significance is attached to the patients' responses to the transistorized metronome (pacer) itself. The remaining stutterer is notable for his almost immediate failure to monitor the device's stimulus while attempting to produce paced speech in the clinic setting.

Metronome-Conditioned Speech Retraining for Stuttering 1 2
John Paul Brady Behavior Therapy Volume 2, Issue 2, April 1971, Pages 129–150
A new treatment for severe stuttering is described: metronome-conditioned speech retraining (MCSR). The procedure involves the use of a miniaturized, electronic metronome which is worn behind the ear like the hearing-aid it resembles. The treatment is derived from a behavioral analysis of the disorder of stuttering and experimental studies on the effects of a metronome on the speech of stutterers. The performance characteristics of a metronome suitable for this procedure are given along with a detailed description of the MCSR procedure itself. The application of this treatment approach to 26 severe stutterers who ranged in age from 12 to 53 years is also presented. Of the 23 patients who completed the treatment program, 21 (or over 90%) showed a marked increase in fluency and an improvement in their general adjustment as well. These clinical results have persisted for follow-up periods that range from 6 months to over 3 years. These results compare favorably with available data on treatment outcome with alternative methods of treatment. Common objections to this general approach to the treatment of stuttering are also discussed.

Prolonged Speech and Camperdown Programme

Camperdown Program for adults who stutter: a student training clinic Phase I trial
Objectives: During speech pathology professional preparation there is a need for adequate student instruction with speech-restructuring treatments for adults. An important part of that clinical educational experience is to participate in a clinical setting that produces outcomes equivalent to those attained during clinical trials. A previous report showed that this is possible with a traditional, intensive speech-restructuring treatment. Considering the treatment process advantages and time efficiency of the Camperdown Program, it is arguably a compelling prospect for clinician education. Therefore, the present study is a Phase I trial of the treatment at a student university clinic, with a similar design to a previous report.

Background: During speech pathology professional preparation there is a need for adequate student instruction with speech-restructuring treatments for adults. An important part of that clinical educational experience is to participate in a clinical setting that produces outcomes equivalent to those attained during clinical trials. A previous report showed that this is possible with a traditional, intensive speech-restructuring treatment. Considering the treatment process advantages and time efficiency of the Camperdown Program, it is arguably a compelling prospect for clinician education.

Aims: The present study is a Phase I trial of the treatment at a student university clinic, with a similar design to a previous report.

Methods & Procedures: The design was a non-randomized Phase I clinical trial with 12 adult participants. Primary outcomes were per cent syllables stuttered (%SS) within and beyond the clinic, and speech naturalness scores from pre- and post-treatment stutter-free speech samples.
Outcomes & Results: Pooled %SS scores pre-treatment were 5.7, at immediate post-treatment were 1.0, and at 12 months post-treatment were 2.4. The group speech naturalness scores post-treatment did not increase to a clinically significant extent.

Conclusion & Implications: Results essentially replicate the previous study by producing similar outcomes to those attained with clinical trials. The Camperdown Program is recommended as a clinical environment for speech restructuring speech pathology student training.

Comments on Recent Developments in Stuttering Treatment Maintenance Research Using the Camperdown Program (Letter to the Editor)
Roger J. Ingham

Purpose: To review the contribution of recent studies on the Camperdown Program (O'Brian, Onslow, Cream, & Packman, 2003) for treating stuttering in adolescents and adults toward the problem of maintenance of treatment benefits.

Method: The procedures employed in those studies are reviewed with respect to the use of performance-contingent maintenance schedules, including their recent use in conjunction with social anxiety modification.

Conclusion: The design of the recent studies of the Camperdown Program confounds the effects of maintenance strategies and treatment outcome evaluation, thereby obscuring their contribution toward resolving the problem of maintenance. The problem of maintaining the benefits of stuttering treatment remains a perennial issue (see Bloodstein & Ratner, 2008; Boberg, 1981). Recent texts indicate that there have been very few developments in research on the maintenance of stuttering treatment benefits for adults and adolescents since the 1980s (e.g., Bloodstein & Ratner, 2008). For that reason alone, some recent investigations by Onslow and colleagues that address this topic are of interest. They are also particularly interesting because they have taken a relatively fresh approach to the maintenance problem: They have started to investigate the role of social, emotional, and cognitive (SEC) variables in the maintenance of effects produced by prolonged speech treatments. I discuss more about this in the paragraphs below.

This recent maintenance research development has largely emerged out of treatment studies on a prolonged speech program known as the Camperdown Program (O'Brian, Onslow, Cream, & Packman, 2003).

Randomized Controlled Non-Inferiority Trial of a Telehealth Treatment for Chronic Stuttering: The Camperdown Program...
Carey B; O'Brian S; Onslow M; Block S; Jones M; Packman A International Journal of Language & Communication Disorders (INT J LANG COMMUN DISORD), 2010 Jan-Feb; 45 (1): 108-20. (50 ref).

Although there are treatments that can alleviate stuttering in adults for clinically significant periods, in Australia there are barriers to the accessibility and availability of best-practice treatment. Aims: This parallel group, non-inferiority randomized controlled trial with multiple blinded outcome assessments investigated whether telehealth delivery of the Camperdown Program provides a non-inferior alternative to face-to-face treatment for adults who stutter.

Methods & Procedures: Forty participants who presented to a university speech clinic were randomized: 20 to the telehealth arm and 20 to the face-to-face arm. Exclusion criteria were age younger than 18 years, frequency of stuttering less than 2% of syllables stuttered and previous speech-restructuring treatment within the past 12 months. The Camperdown Program for adults who stutter was the intervention. Primary outcome measures were frequency of stuttering measured in per cent syllables stuttered (%SS) before treatment and at 9 months post-randomization and efficiency, measured by counting the number of speech pathologist contact hours used by each participant.
Intention to treat analysis was conducted using last observation carried forward. Secondary outcome measures were speech naturalness, self-reported stuttering severity, and treatment satisfaction. Outcomes & Results: There was no statistically or clinically significant difference in %SS between the two groups at 9 months post-randomization. Analysis of covariance adjusting for baseline %SS showed telehealth had 0.8% absolute lower per cent syllables stuttered than face-to-face. There were also no differences in %SS between groups immediately post-treatment, or at 6 months and 12 months post-treatment (p ¼ 0.9). In the second primary outcome measure, the telehealth group used statistically less contact time (221 min) on average than the face-to-face group (95% confidence interval = -387 to -56 min, p = 0.01). Conclusions & Implications: The results provide evidence to support the use of the Camperdown Program delivered by telehealth as an alternate to the face-to-face treatment delivery of this programme for adults who stutter. Such a model will increase accessibility to this evidence-based treatment for adults currently isolated from treatment services.

http://content.ebscohost.com/pd23_24/pdf/2010/B7U01Jan10/45683559.pdf?T=P&P=AN&amp;K=2010504995&S=R&amp;D=c8h&amp;EbscoContent=dGJyMMTo50SegkK84xNgqOLCmr0yeprVSxqc4TbQWyWXS&amp;ContentCustomer=dGJyMOzpr0x2ra9RuePfgeyx44DigitA

Telehealth Delivery of the Camperdown Program for Adults Who Stutter: A Phase I Trial

Purpose: This Phase I trial investigated the viability of telehealth delivery of the Camperdown Program with adults who stutter. This program involves speech restructuring.

Method: All treatment was conducted remotely with participant–clinician contact occurring by telephone and e-mail.

Results: Ten adults completed the program. The group showed an 82% reduction in stuttering frequency immediately after treatment and a 74% reduction 6 months after treatment. However, there was significant individual variation in response to the program. Conclusion: These preliminary data suggest that telehealth Camperdown has the potential to provide efficacious treatment for clients who do not have access to traditional face-to-face treatment.

http://content.ebscohost.com/pdf19_22/pdf/2008/1SM/01Feb08/28773991.pdf?T=P&P=AN&amp;K=2009800596&S=R&amp;D=c8h&amp;EbscoContent=dGJyMMTo50SegkK84xNgqOLCmr0yeprVSsa%2B4s6%2BWxWXS&amp;ContentCustomer=dGJyMOzpr0x2ra9RuePfgeyx44DigitA

The Effects of Simulated Stuttering and Prolonged Speech on the Neural Activation Patterns of Stuttering and Nonstuttering Adults
Luc F. De Nila, Deryk S. Beala, Sophie J. Lafaillea, Robert M. Krolla, Adrian P. Crawley, Vincent L. Graccoe, Brain and Language Volume 107, Issue 2, November 2008, Pages 114–123

Functional magnetic resonance imaging was used to investigate the neural correlates of passive listening, habitual speech and two modified speech patterns (simulated stuttering and prolonged speech) in stuttering and nonstuttering adults. Within-group comparisons revealed increased right hemisphere biased activation of speech-related regions during the simulated stuttered and prolonged speech tasks, relative to the habitual speech task, in the stuttering group. No significant activation differences were observed within the nonstuttering participants during these speech conditions. Between-group comparisons revealed less left superior temporal gyrus activation in stutterers during habitual speech and increased right inferior frontal gyrus activation during simulated stuttering relative to nonstutterers. Stutterers were also found to have increased activation in the left middle and superior temporal gyri and right insula, primary motor cortex and supplementary motor cortex during the passive listening condition relative to nonstutterers. The results provide further evidence for the presence of functional deficiencies underlying auditory processing, motor planning and execution in people who stutter, with these differences being affected by speech manner.
Considerable research has been directed at the outcomes of prolonged-speech (PS) treatment for the control of chronic stuttering, but little research to date has focused on the PS treatment process. This report examines a Stage 2 clinical trial of a reconceptualized PS treatment model known as the Camperdown Program. This program requires fewer clinician hours than traditional programs and has no formal transfer phase. Additionally, it incorporates the following treatment process innovations, which replace treatment process components that are intuitively and empirically problematic: (a) PS is taught without incorporating target behaviors in clinician instruction, (b) participants learn to control stuttering without programmed instruction, and (c) the treatment process does not involve clinician identification of stuttering moments. Thirty participants were initially enrolled in the trial. Final outcome data are presented for the 16 participants who completed all trial requirements, including 12 months posttreatment data collection. These 16 participants showed minimal or no stuttering in everyday speaking situations for up to 12 months after entering the maintenance program, with speech rates in the normal range. Speech naturalness and social validation data were also favorable. Although self-report data generally confirmed the speech data, the results were not as positive. The present outcomes were achieved in a mean of 20 hours of clinic attendance per participant, which is much fewer than the hours required by treatment programs reported recently that run intensively over 2–3 weeks. The promise of this Stage 2 clinical trial has led the authors to initiate a Stage 3 randomized controlled trial of the Camperdown Program.


Time is past due for public discussion of an article by O’Brien, Onslow, Cream, and Packman (2003) that reported the outcomes of Camperdown, a ‘reconceptualized’ prolonged speech (PS) treatment program. According to the authors, their new model ‘introduces the following treatment process innovations’ (p. 935): (a) replacement of vague, verbally described PS performance targets (e.g., soft contacts, gentle voice onset, and a very slow speech rate) with a modelling procedure requiring imitation of a videotape demonstration of PS, and (b) replacement of stepwise programmed instruction for instating and transferring PS with practice and problem-solving sessions using clinician guidance and feedback. These innovations speak principally to two treatment concerns: the need to operationalize performance targets and the need to reduce clinical hours devoted to treatment. The authors found the outcomes of Camperdown to be roughly equivalent to those from an earlier program that required significantly more clinical hours and that instated and transferred PS by using traditional, stepwise programmed instruction (Onslow, Costa, Andrews, Harrison, & Packman, 1996). However, the authors failed to consider the relevant literature that should have informed the background, discussion, and conclusions for their study.

Request from LKRS
Delayed or Altered Auditory Feedback

Review

Altered Auditory Feedback and the Treatment of Stuttering: A Review
Several authors have suggested that devices delivering altered auditory feedback (AAF) may be a viable treatment for adults and children who stutter. This paper reviews published, peer reviewed journal papers from the past 10 years that investigate the effect of AAF during different speaking conditions, tasks and situations. A review of that literature indicates that considerable experimental evidence and limited Phase 1 treatment outcome evidence has been accumulated about the effect of AAF on the speech of people who stutter. However, critical knowledge about the effect of AAF during conversational speech and in everyday speaking situations is missing. Knowledge about how to determine the correct levels of AAF for individuals, and the characteristics of those likely to benefit from AAF, also needs to be established. At present there is no reason to accept a recent suggestion that AAF devices would be a defensible clinical option for children. In general device development and availability has occurred at a faster pace than clinical trials research.

Educational objectives: After reading this paper readers should be able to: (1) describe what altered auditory feedback is and common ways the speech signal is altered in stuttering; (2) describe the effects of AAF on the speech of adults who stutter; (3) provide a critical analysis of the literature in the area of AAF and stuttering.

REVIEW ARTICLE

Using Delayed Auditory Feedback in the Treatment of Stuttering: Evidence to Consider
BACKGROUND: there is some indication that the use of delayed auditory feedback (DAF) is a potentially helpful technique in the treatment of stuttering. Several devices for DAF are also commercially. However, not all individuals who stutter experience a positive effect on speech fluency when speaking under DAF. And those who do show a positive effect, may differ considerably as to the degree and the conditions in which the effect is seen. Therefore, the decision whether or not to attempt the use of DAF in an given client is usually not straightforward.
AIM: starting from a literature review, the present paper discusses and illustrates factors to take into account when considering the use of RAA in an individual client. Four types of factors are distinguished: factors inherent to the client such as gender, age, stuttering severity, dysfluency pattern, origin of stuttering, and biological subtype; factors outside the client including delay time, intensity, manner of delivery, speech mode, and speech situation; possible side-effects like a reduction in speech rate, an increase of speaking fundamental frequency and vocal intensity, lengthening of vowels, and a possible effect on speech naturalness; others namely cosmetics, finances, and the long-term effect.
CONCLUSION: the review shows that most likely multiple factors play a role, but with the currently available data it is very hard to predict whether a given individual will or will not benefit from the use of DAF. Overall, the evidence for the influence of the different factors is still meager. Moreover, some studies present data of a quality that can hardly be considered "evidence".
Altered Auditory Feedback for Treatment of Stuttering Medical and Behavioral Health Policy Manual

Behavioral Health Effective Date: 03/11/2013

Description:

Stuttering is a speech disorder in which the normal flow of speech is disrupted by frequent repetitions or prolongations of speech sounds, syllables or words, or by the inability to start a word. Developmental stuttering, the most common form of stuttering, occurs in young children while they are still learning speech and language skills. Neurogenic stuttering may occur after a stroke, head trauma, or other type of brain injury. Conventional treatment for stuttering involves speech therapy, using a variety of therapeutic approaches. Treatment may focus on learning new speaking strategies or on behavior modification.

Altered Auditory Feedback (AAF) has been proposed as a treatment of stuttering. AAF devices use auditory feedback via an earpiece worn in or behind the ear and involve the following techniques, which may be used alone or in combination: Delayed Auditory Feedback (DAF) – delay of the user’s voice to his/her ears for a fraction of a second; Frequency Altered Feedback (FAF) – shift in the pitch of the user’s voice in his/her ears.

The U.S. Food and Drug Administration (FDA) categorizes stuttering devices as Class I devices. This category of device is exempt from premarket notification procedures. A number of AAF devices, using both DAF and FAF, are commercially available including the following: Speech Easy (Janus Development Group); Pocket Speech Lab, Small Talk, Basic Fluency System, Telephone Fluency System, School DAF (Casa Futura Technologies); VoiceAmp 601 system (VoiceAmp); Fluency Master (National Association for Speech Fluency); Defstut (A.S. Genstar Limited); DSA III (Digital Recording); KayPentax Facilitator (Kay Elementrics).

Policy: The use of any altered auditory feedback device for the treatment of stuttering is considered INVESTIGATIVE due to a lack of evidence demonstrating an impact on improved health outcomes.

http://notes.bluecrossmn.com/web/medpolman.nsf/d61488461cefe1e2862567cc00694601/e0f7be1aa9bc522a862571d50070acf2/$FILE/Altered%20Auditory%20Feedback%20for%20Treatment%20of%20Stuttering.pdf

Altered Auditory Feedback (AAF) Devices for the Treatment of Stuttering

Current Effective Date: 10/08/2013
Status: Reviewed
Last Review Date: 08/08/2013

Description/Scope: This document addresses the use of altered auditory feedback (AAF) devices for the treatment of stuttering.

Position Statement: Investigational and Not Medically Necessary: Altered auditory feedback (AAF) devices are considered investigational and not medically necessary for the treatment of stuttering.

This document looks around issues and successfulness of auditory feedback for stammering.

http://www.anthem.com/medicalpolicies/policies/mp_pw_a050289.htm

The Effect of SpeechEasy on Stuttering Frequency, Speech Rate, and Speech Naturalness


The effects of SpeechEasy on stuttering frequency, stuttering severity self-ratings, speech rate, and speech naturalness for 31 adults who stutter were examined. Speech measures were compared for samples obtained with and without the device in place in a dispensing setting. Mean stuttering frequencies were reduced by 79% and 61% for the device compared to the control conditions on reading and monologue tasks, respectively. Mean severity self-ratings decreased by 3.5 points for oral reading and 2.7 for monologue on a 9-point scale. Despite dramatic reductions in stuttering frequency, mean global speech rates in the device condition increased by only 8% in the reading task and 15% for the monologue task, and were well below normal.
Further, complete elimination of stuttering was not associated with normalized speech rates. Nevertheless, mean ratings of speech naturalness improved markedly in the device compared to the control condition and, at 3.3 and 3.2 for reading and monologue, respectively, were only slightly outside the normal range. These results show that SpeechEasy produced improved speech outcomes in an assessment setting. However, findings raise the issue of a possible contribution of slowed speech rate to the stuttering reduction effect, especially given participants’ instructions to speak chorally with the delayed signal as part of the active listening instructions of the device protocol. Study of device effects in situations of daily living over the long term is necessary to fully explore its treatment potential, especially with respect to long-term stability.

Educational objectives: The reader will be able to discuss and evaluate: (1) issues pertinent to evaluating treatment benefits of fluency aids and (2) the effects of SpeechEasy on stuttering frequency, speech rate, and speech naturalness during testing in a dispensing setting for a relatively large sample of adults who stutter.

**Effects of Altered Auditory Feedback (AAF) On Stuttering Frequency during Monologue Speech Production**


The present study investigated the immediate effects of eight altered auditory feedback (AAF) parameters on stuttering frequency during monologue speech production on two occasions. One of the modern commercially available portable anti-stuttering devices, “The Pocket Speech Lab” (Casa Futura Technologies®) was used in the study to produce the auditory feedback alterations. Six types of combined delayed auditory feedback (DAF) and frequency shifted auditory feedback (FAF) and two types of DAF alone were tested for eight participants aged 16–55 years, with stuttering severity ranging from mild to severe. The present study found that AAF is an effective means to reduce stuttering frequency during monologue speech production. All eight AAF experimental conditions reduced stuttering frequency, however, there was substantial variability in the stuttering reduction effect across experimental conditions and across participants. There was also instability in stuttering reduction across the two testing sessions. On average, a 75 ms time delay on its own and a combination of the 75 ms time delay and a half octave downward frequency shift were found to be more effective than other combinations of AAF parameters that were investigated.

Educational objectives: After reading this paper, the reader should be able to (1) summarize the research investigating the effect of altered auditory feedback on stuttering frequency during monologue speech production; (2) describe the stuttering reduction effect of the eight parameters of AAF tested during monologue speech production; and (3) discuss the possible clinical implications of the use of AAF for stuttering treatment.


**Speecheasy Wireless Altered-Auditory Feedback (AAF) Device for Stammer**

September 2007 National Horizon Scanning Centre

This is a wireless form of delayed auditory feedback, giving information on the product itself in comparison to others.

Request from LKRS
Auditory Cortex, Altered Auditory Feedback and Developmental Stuttering

Initial studies of SpeechEasy  Anne L. Foundas, M.D. and Edward G. Conture, Ph.D.

From the Stuttering Foundation's fall 2007 newsletter

Our knowledge of the biological bases of developmental stuttering has been greatly enhanced by recent results of brain imaging and physiological studies. Taken together, these complementary methods have begun to provide converging evidence about the brain regions that may be affected in individuals who stutter. For example, there is strong evidence that dysfunctions in auditory cortical brain regions may contribute to developmental stuttering. Related to these findings, numerous investigators have studied how altered auditory feedback may influence speech fluency in individuals with developmental stuttering (e.g., Armson, Kiefte, Mason, & DeCroos, 2006; Stuart, Kalinowski, Armson, Stenstrom & Jones, 1996; Van Riper, 1973, pp. 116-139). These alterations have involved such procedures as low-pass and high-pass auditory masking (e.g., Conture, 1974), delayed auditory feedback (DAF) (Van Riper, 1973), and frequency altered feedback (FAF) (Armson et al., 2006). To greater or lesser degrees, these various alterations in speaker's auditory feedback for speech have been shown to reduce stuttering during reading as well as conversational speech. However, what is still unknown is whether there are predictable relationships between auditory cortical brain regions (structure and function) and changes in stuttering to altered auditory feedback.

In our first volumetric MRI study of developmental stuttering we found structural anomalies within a discrete brain region — a portion of auditory temporal cortex (Foundas et al., 2001). Other studies have found atypical activation-deactivation in this same brain region and atypical physiological responses when adults who stutter are compared to adults who do not stutter (for review, Brown et al., 2005). In a subsequent study we found that adults with developmental stuttering and atypical auditory temporal anatomy had enhanced fluency with DAF, but adults with developmental stuttering and typical anatomy showed less improvement under conditions of DAF (Foundas et al., 2004).

Although alteration in auditory feedback for speech appears effective, at least in the short term, for some individuals who stutter, there is a limited understanding of the means by which stuttering changes as a result of alterations in speakers' air-borne auditory feedback for speech and language. With recent advances in digital technology, however, one such device has been widely marketed and empirically studied, that is, the SpeechEasy (2001).

The SpeechEasy is a small device which looks and fits like a hearing aid. This device works in essence by "playing a copy" of the person's own speech in their ear after shifting the pitch as well as creating a temporal delay in the acoustic output of their speech production. According to SpeechEasy's associated marketing literature, such adjustments or alterations in auditory feedback for speech supposedly mimic the effects of choral reading. One empirical study (Armson et al., 2006) showed that the SpeechEasy reduced stuttering events by 49%, 36%, and 74% respectively for conversation, monologue, and reading. Fluency was even more enhanced in all speaking conditions with the instruction to deliberately prolong vowels.

At present, there are several unanswered questions: How does the SpeechEasy device work at the level of the auditory cortex? How does the SpeechEasy device relate to brain anatomy and function? Our research group is interested in investigating these important questions. Our research group at Tulane, in collaboration with Dr. Edward G. Conture and colleagues at Vanderbilt, are conducting pilot studies to objectively examine the SpeechEasy in a small group of adults with persistent developmental stuttering.

Overall, results of this study should provide crucial, objective information for further, larger-scale study of this device, particularly relative to how cortical activity and structure relates to those who do versus those who do not benefit from using the device. The proposed studies
have considerable theoretical and clinical significance. The proposed studies should provide a biological framework that will allow us to learn more about the structure and function of auditory cortical regions in adults who do and do not stutter. Furthermore, it is thought that such studies may lead to more targeted interventions using the SpeechEasy to help those individuals with developmental stuttering seeming most able to receive benefit from such treatment.


In the Ear Devices on the Speech of People who Stutter: Initial Fitting and Four Month Follow Up.
Aims: The paper examines the first therapeutic application of self-contained ear-level devices in three experiments. The effect of the device on the proportion of stuttered syllables and speech naturalness was investigated following initial fitting and at 4 months post-fitting.

Request from LKRS

Fluency Effect of Frequency Alternations of Plus/Minus One-Half and One-Quarter Octave Shifts in Auditory Feedback of People Who Stutter.
The effect of frequency alterations in auditory feedback of people who stutter on stuttering frequency was investigated. Twelve participants who stutter read aloud under nonaltered auditory feedback (NAF) and four conditions of frequency-altered feedback ([FAF], plus/minus one-half and one-quarter octaves) at normal and fast speech rates. Stuttering frequency was significantly higher while reading aloud with NAF relative to the four conditions of FAF (p < 0.05). There were no differences among participants’ stuttering frequency between the four FAF conditions (p > 0.05). Reductions in stuttering frequency of approximately 50% to 60% were found with FAF relative to NAF. More disfluencies occurred with the fast versus the normal speech rate condition (p = .0007) irrespective of auditory feedback condition. These findings suggest that slight alterations in the frequency of auditory feedback of people who stutter are fluency-enhancing.

The Perception of Speech Naturalness of Post-Therapeutic and Altered Auditory Feedback Speech of Adults with Mild and Severe Stuttering.
The effect of therapy and altered auditory feedback (AAF) on the perception of speech naturalness of people who stutter was examined. Thirty-five naive young adult listeners rated speech samples from fluent speakers and individuals who stutter. Samples came from normal adults who spoke Standard American English; adults with mild or severe stuttering who spoke under conditions of non-altered feedback (NAF), delayed auditory feedback (DAF), and frequency-altered feedback (FAF); and adults with mild or severe stuttering prior to and following successful completion of a Precision Fluency Shaping Program. Speech produced under AAF was rated as significantly more natural sounding than speech from the same individuals under NAF (p < 0.0001). Speech produced during FAF was judged to be more natural sounding than that produced during DAF for those with mild (p = 0.003) and severe (p < 0.0001) stuttering. Mild stuttered speech was judged to have more natural-sounding speech than severe stuttered speech during AAF (p < 0.0001). Speech from individuals following therapy was rated significantly less natural sounding than that from individuals during AAF for both mild and severe stuttering (p < 0.0001).
The speech of individuals prior to therapy was rated significantly more natural than their speech produced after therapy \( (p < 0.0001) \). Speech from normal fluent speakers was rated as significantly more natural sounding than all samples produced from the individuals who stutter \( (p < 0.0001) \). These findings support the contention that AAF benefits those who stutter through a reduction of stuttering with a gain in perceived speech naturalness.

**Stuttering Ameliorate on At Various Auditory Feedback Delays and Speech Rates**

Joseph Kalinowski, Andrew Stuart, Sarah Sark, Joy Armson 1996 Royal College of Speech & Language Therapists

The primary purpose of this study was to determine if the finding of Kalinowski et al. (1993) of dramatic reductions in stuttering under delayed auditory feedback (DAF) at normal and fast speech rates could be replicated. The second purpose was to determine if stuttering frequency is differentially affected by various delays in an attempt to identify the optimal delay for fluency enhancement for both normal and fast speech rates. Fourteen adult stutterers read eight different passages at either a normal or fast speech rate under non-altered auditory feedback (NAF) and DAF with delays of 25, 50 and 75 ms. Results showed that significant fluency enhancement occurred under DAF at both normal and fast speech rates at all DAF settings \( (p < 0.05) \). This finding corroborates the notion that a slowed rate of speech is not a necessary antecedent for fluency improvement under conditions of altered auditory feedback. In addition, the results indicated that 50 ms appears to be the shortest delay producing the maximum reduction in stuttering frequency.

**Altered Auditory Feedback...Some Perspectives**

A powerpoint presentation.

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